The Baltimore Traffic Study: Assessment of Air Quality Impact and Model Development

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And Reduction Strategies
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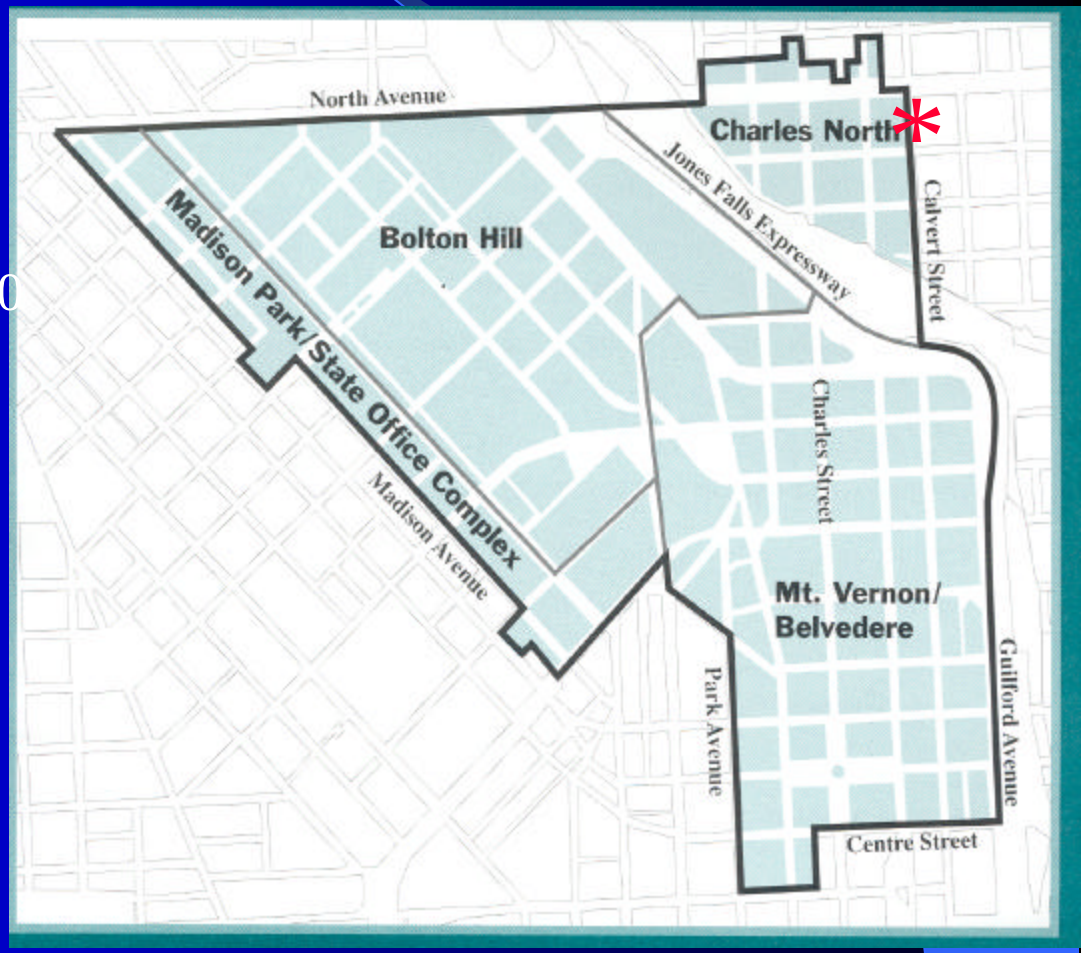
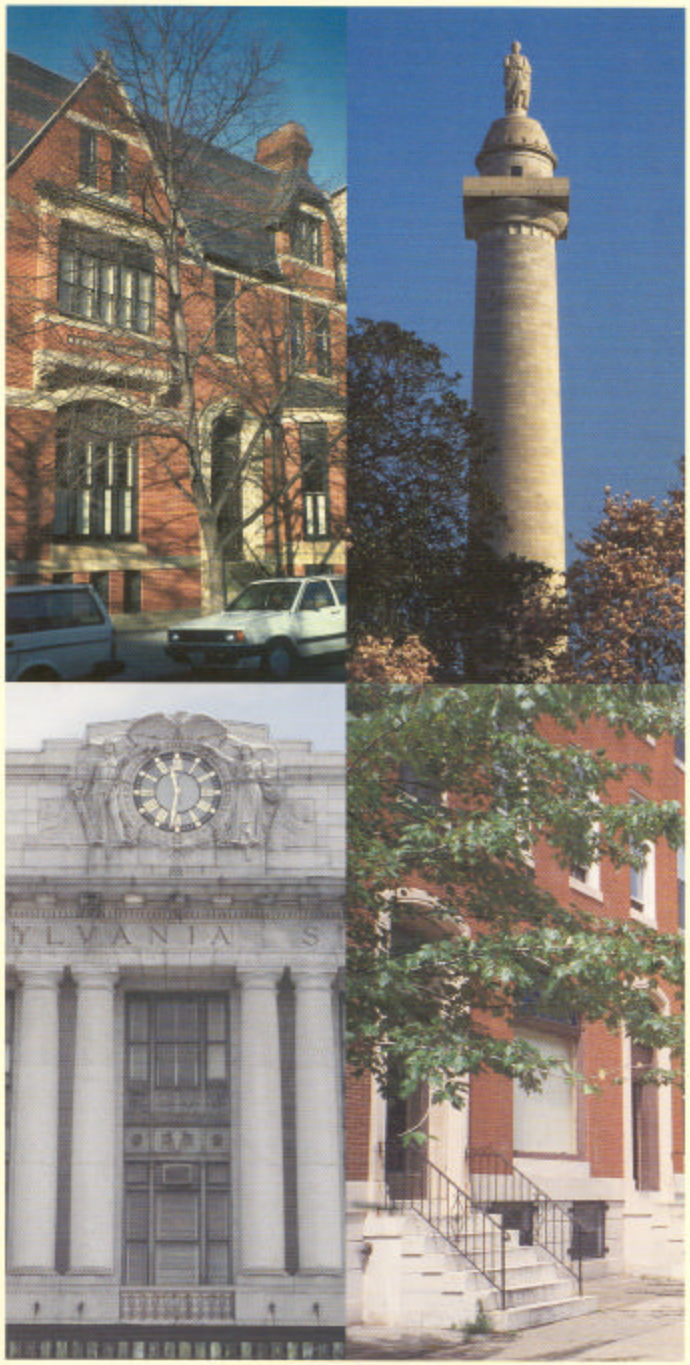
Purpose

- Assess the impact of traffic on community air quality
- Evaluate traffic related air quality variability by hour of day, day of week, season
- Characterize relationship between indoor and outdoor air pollution concentrations

The Community

- Midtown
  - 100 City Blocks
  - Population of 11,000
  - 25% with HH Income <$15,000
  - Bolton Hill (36% AA)
  - Mount Vernon (35% AA)
  - Charles North (92% AA)
  - Transportation Impact
    - Four major arterials
    - Expressway
    - Rail line





Midtown Community Plan

Bolton Hill

Charles North

Madison Park

Mount Vernon

Chapter II. Changing the Environment

- "Midtown's greatest problem is its current pattern of traffic, transit and parking . . ."

- "More than any other factor or combination of factors, existing conditions in transportation are weakening Midtown and preventing it from fulfilling its mission as a magnet for people and investment."

- Traffic: There is too much traffic, particulary on key Residential streets like Calvert and St. Paul. Everyone of Midtown's main north-south streets now serves as a commuter raceway and bus route.

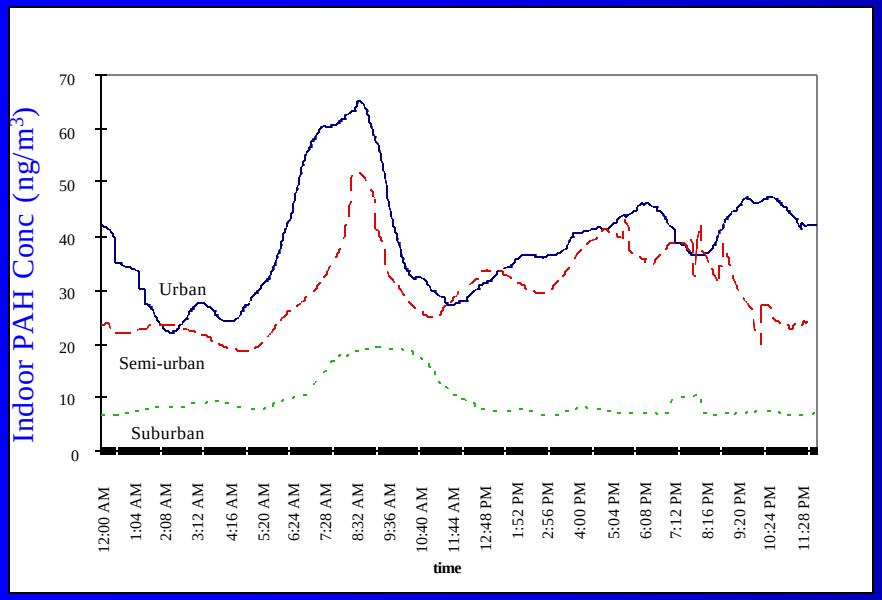

I 83
RAMP
CLOSED
ROAD CLOSED
NO ACCESS
TO
I-83
83
DO NOT
ENTER

Rationale

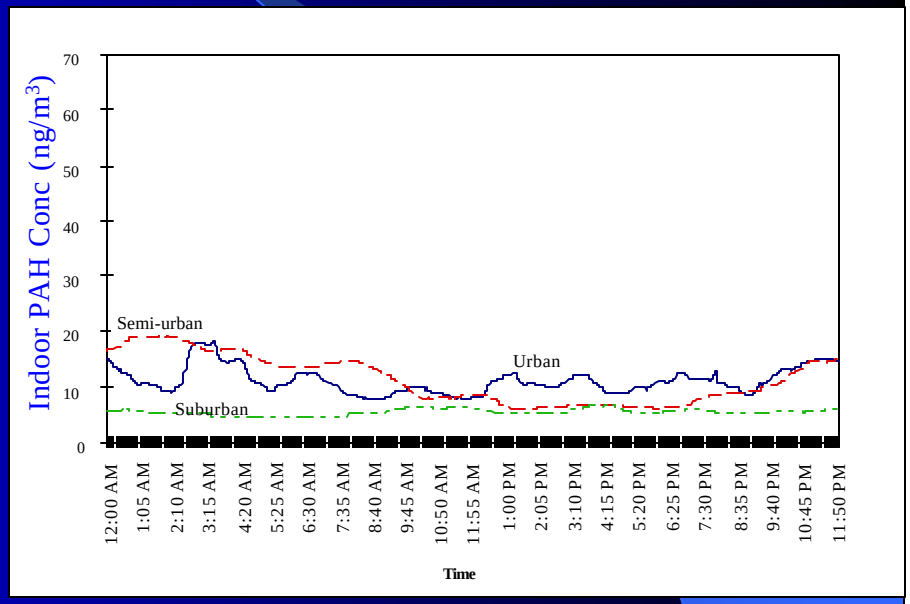
- Community / Public Health
  - Toxic emissions
    - Particles (Kleeman et al. ES&T)
    - Diesel (Kinney et al. 2000)
    - PAH (Dubowsky; Dickhut et al. 2000)
    - CO, NO_x, and VOCs (Chase et al. 2000)
    - Dioxins and furans (Ryan and Gullett, 1999)
  - Emissions in close proximity and integral to human populations
  - Health
    - Cancer (Pearson et al. 2000)
    - Respiratory effects in children (Brunekreef et al. 1997, Wjst et al. 1993, Weiland et al. 1994)

Impact of Traffic on Indoor PAH

Weekday



Weekend



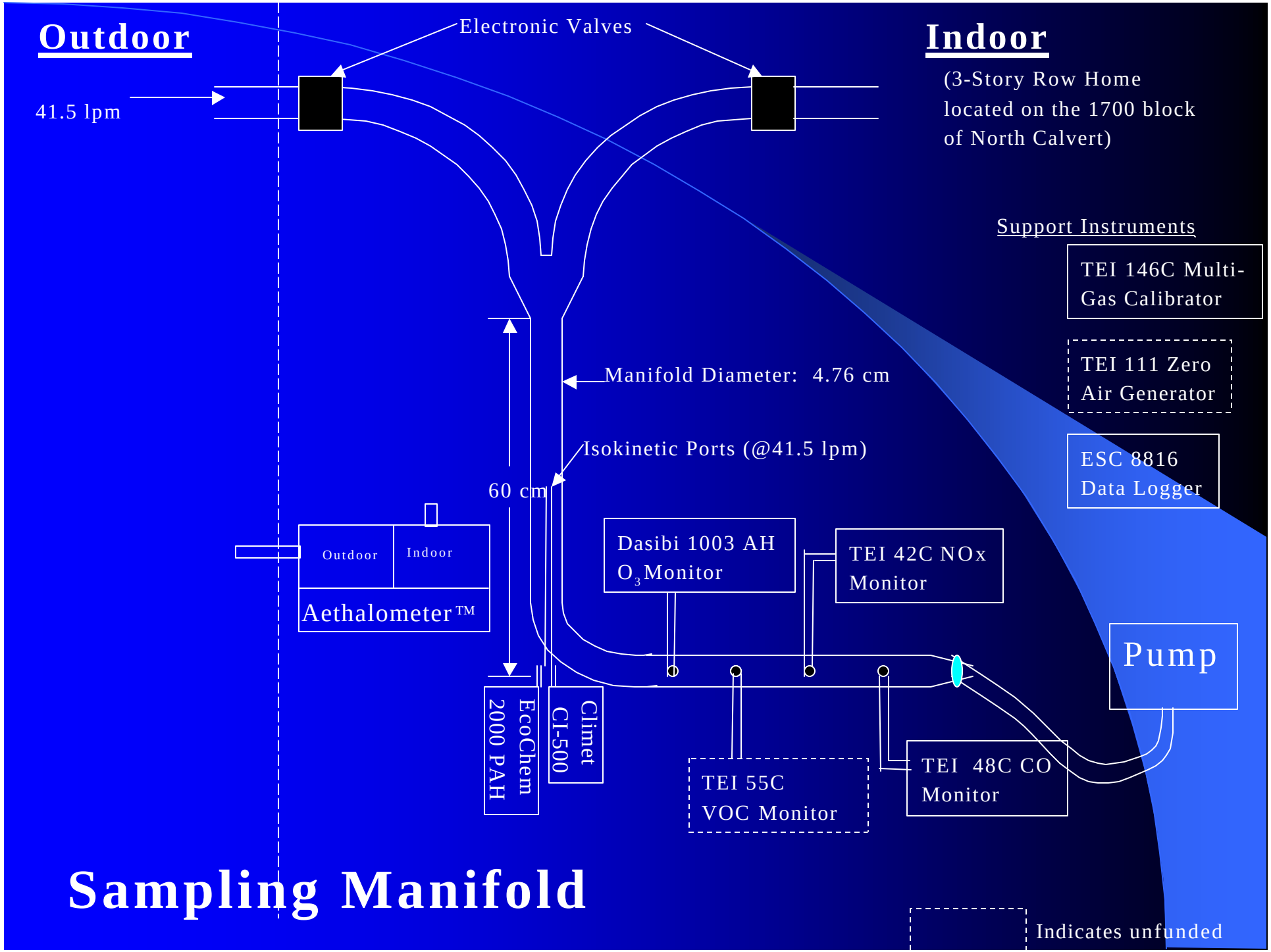
Geometric Mean (ng/m^3)

Urban:	31*
Semi-Urban:	19*
Suburban:	8.0*

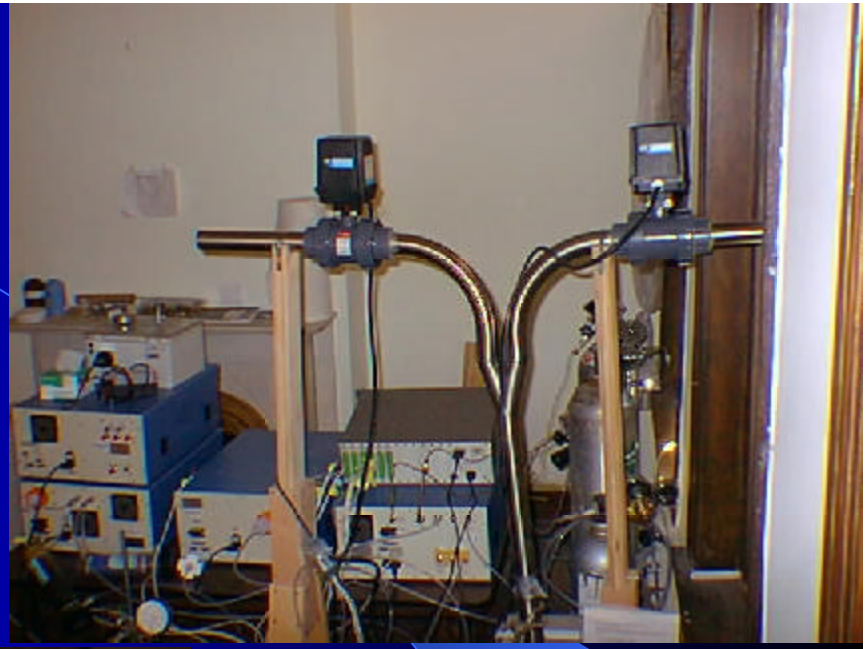
Geometric Mean (ng/m^3)

Urban:	10
Semi-Urban:	9.8
Suburban:	4.9*

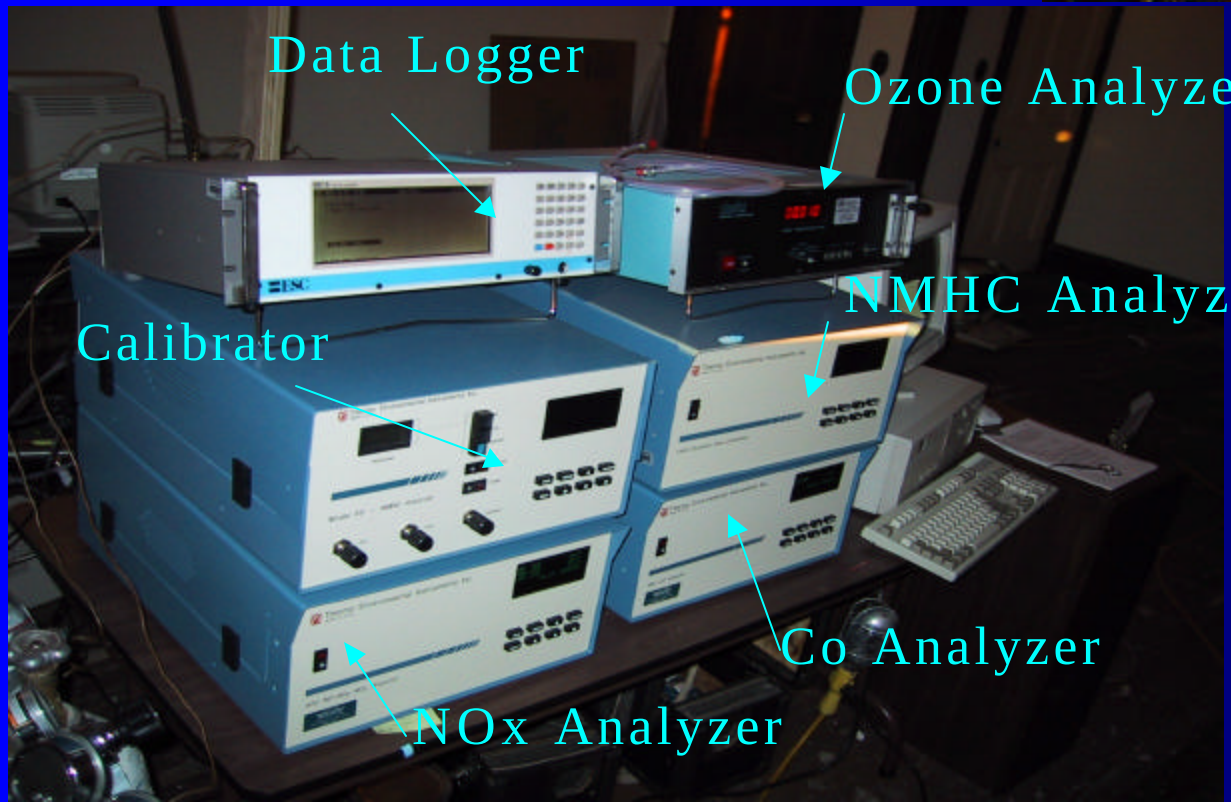
Dubowsky SD; Wallace LA; Buckley TJ (1999): The contribution of traffic to indoor concentrations of polycyclic aromatic hydrocarbons. *J. Exposure Anal. Environ. Epi.* 9(4):312-320.


Outdoor
Electronic Valves
41.5 lpm
Indoor
(3-Story Row Home
located on the 1700 block
of North Calvert)
Support Instruments
TEI 146C Multi-
Gas Calibrator
TEI 111 Zero
Air Generator
ESC 8816
Data Logger
Manifold Diameter: 4.76 cm
Isokinetic Ports (@41.5 lpm)
60 cm
Outdoor
Indoor
Aethalometer™
Dasibi 1003 AH
O3 Monitor
TEI 42C NOx
Monitor
Pump
EcoChem
2000 PAH
Climet
CI-500
TEI 55C
VOC Monitor
TEI 48C CO
Monitor
Sampling Manifold
Indicates unfunded

Instrumentation

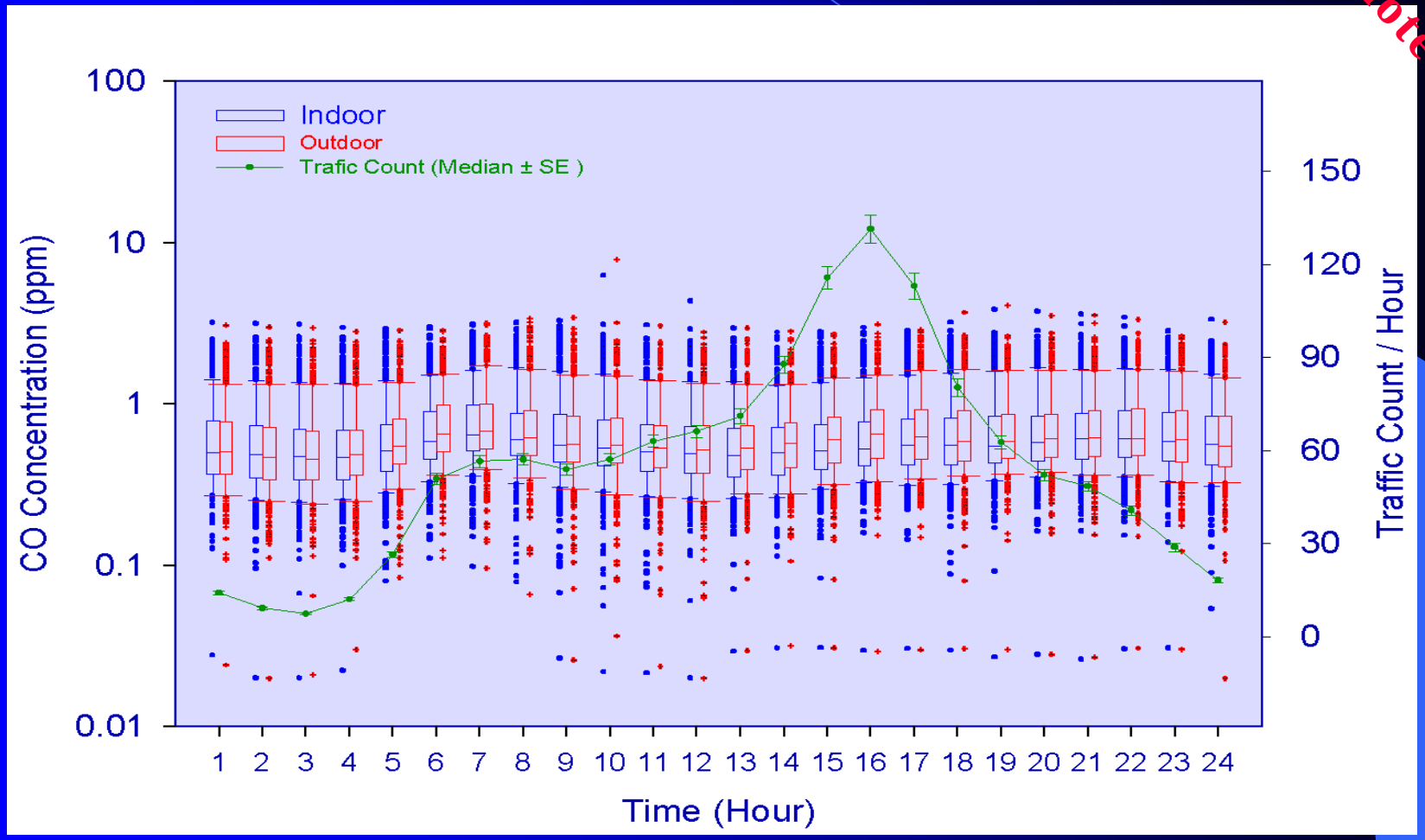


Sampling Manifold



The Residential Fixed Site Monitoring Station

Weekday CO Concentration by Hour (Aug 2000 – Sep 2001)



(NAAQS: 1h=35 ppm; 8h=9 ppm)

Indoor and Outdoor CO Concentration by Day of Week

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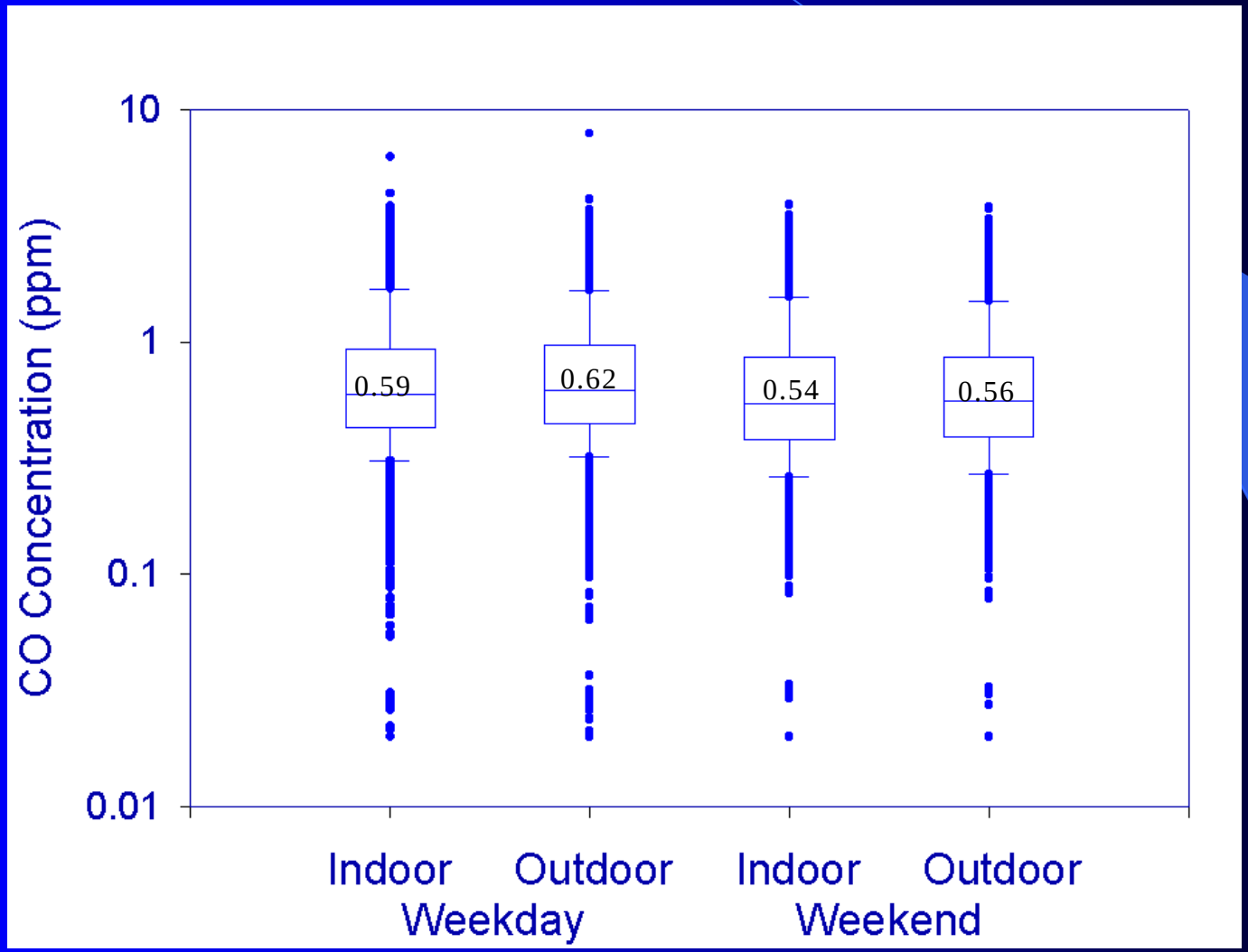

Weekday PAH Concentration by Hour

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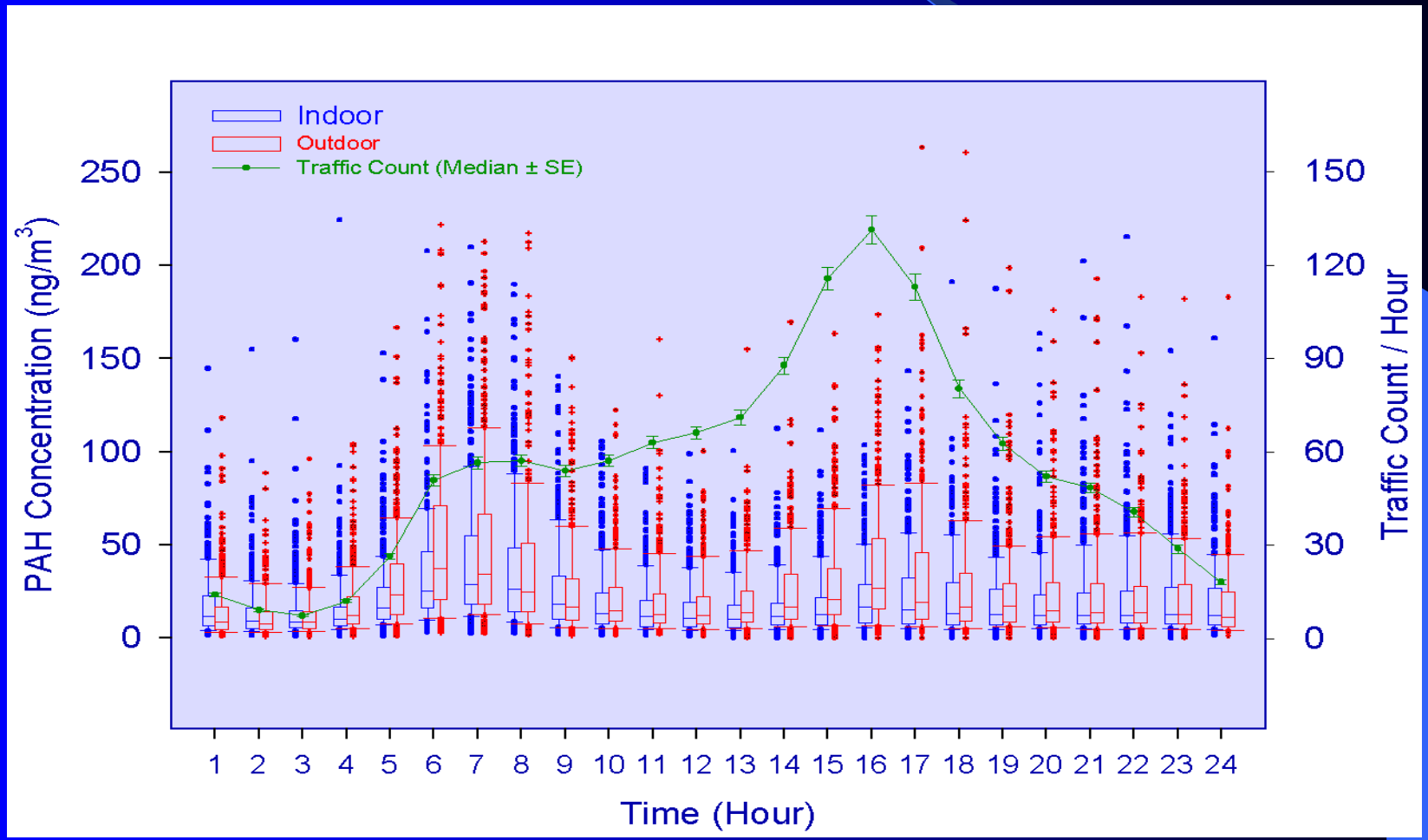
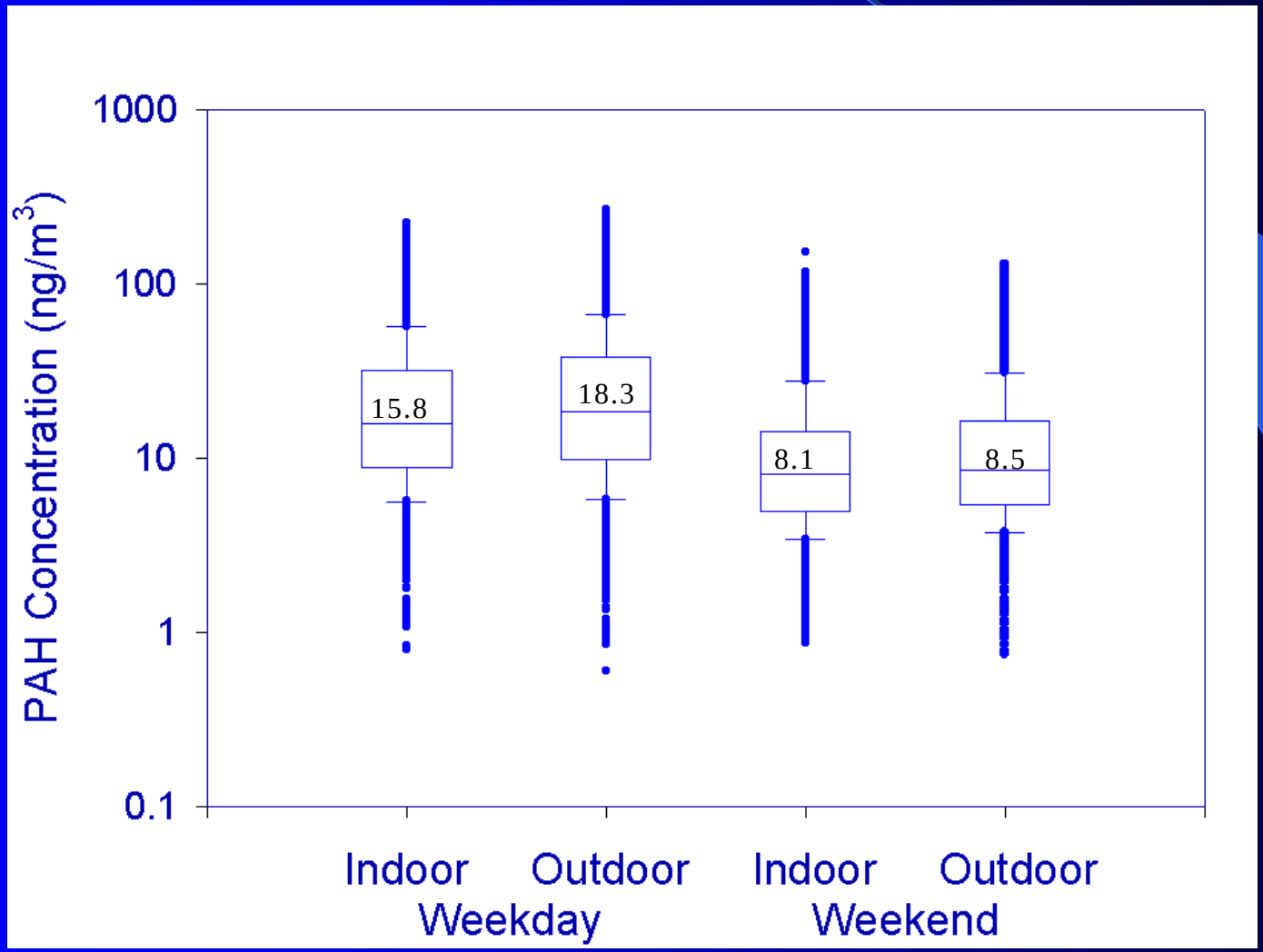


PAH Measured Indoors and Outdoors by Day of Week



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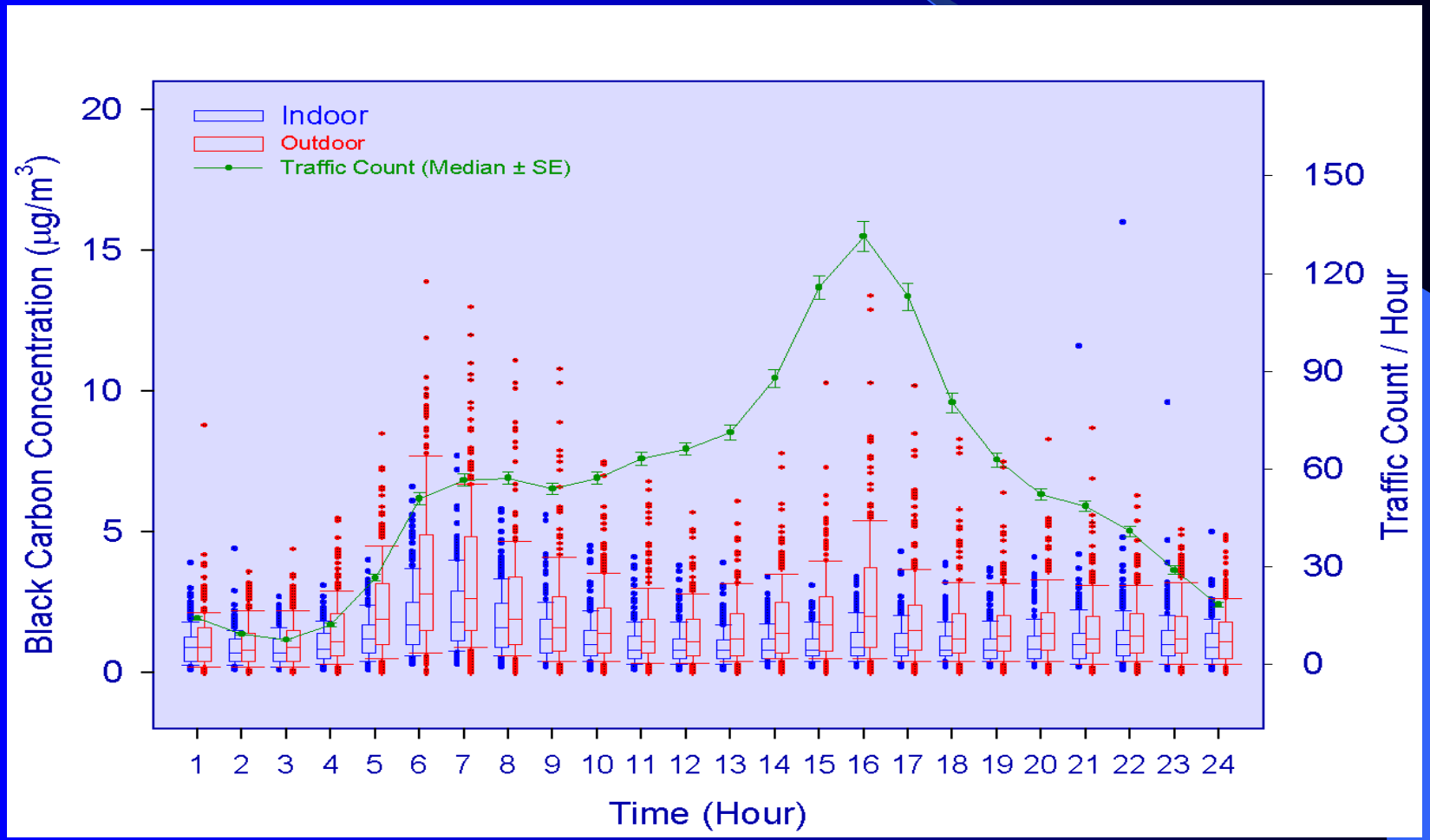
Weekday Black Carbon Concentration by Hour



Black Carbon Measured Indoors and Outdoors by Day of Week

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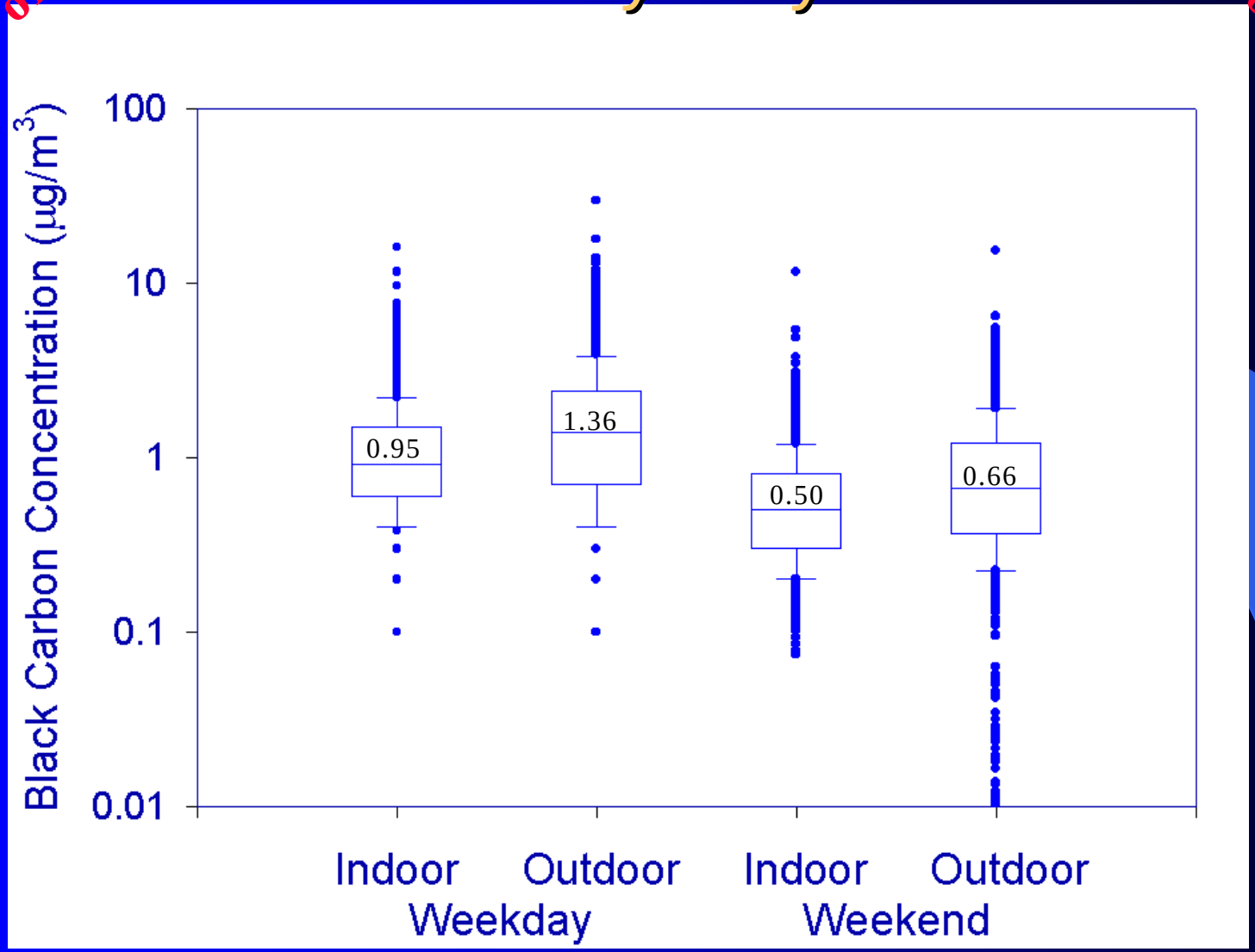
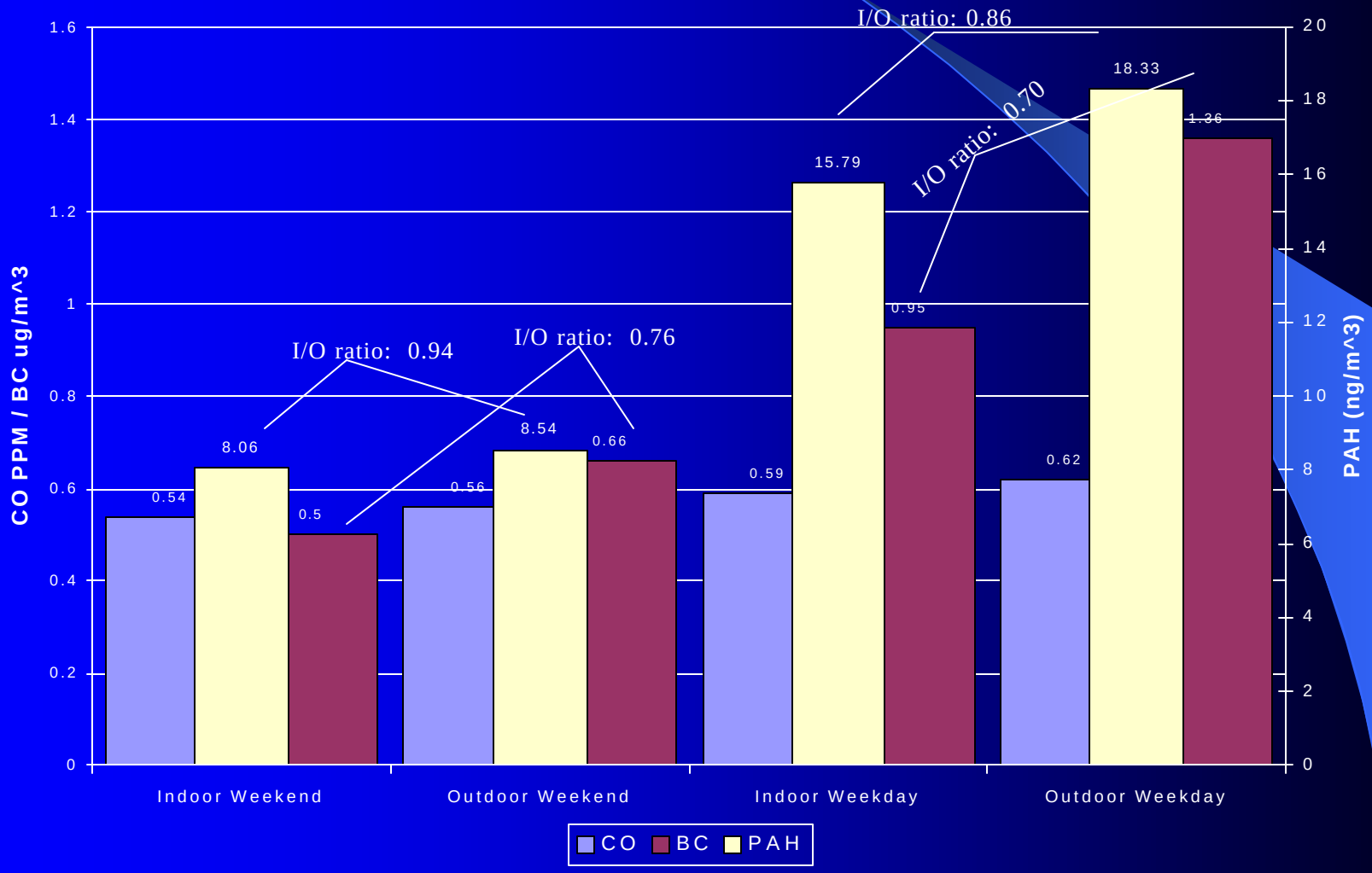


LaRosa et al. (in press): Rural median: 0.70 ug/m^3; Urban Median: 1.4 ug/m^3

Median Air Pollution by Day of Week and Location



Correlation Coefficient for Total Data Set

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	Indoor CO	Outdoor CO	Indoor PAH	Outdoor PAH	Indoor BC	Outdoor BC	Mean count
Indoor CO	1.00[a] [b] 9776[c]						
Outdoor CO	0.98 <.0001 9776	1.00 9776					
Indoor PAH	0.46 <.0001 9760	0.48 <.0001 9760	1.00 9760				
Outdoor PAH	0.38 <.0001 9770	0.43 <.0001 9770	0.84 <.0001 9754	1.00 9770			
Indoor BC	0.28 <.0001 7426	0.30 <.0001 7426	0.72 <.0001 7425	0.59 <.0001 7423	1.00 7657		
Outdoor BC	0.29 <.0001 7306	0.36 <.0001 7306	0.64 <.0001 7305	0.75 <.0001 7303	0.70 <.0001 7537	1.00 7537	
Mean count	-0.08 <.0001 8566	-0.03 0.00 8566	0.07 <.0001 8565	0.23 <.0001 8561	0.04 0.00 6799	0.18 <.0001 6679	1.00 9324

a : Pearson Correlation Coefficients

b : Prob > |r| under H0 : Rho=0

c : Number of Observation

Conclusions

- Traffic–related community air quality impact evaluated for BC and PAH
- CO concentrations low and weak traffic effect
- BC and PAH Indoor/Outdoor ratios < 1 indicate penetration loss
- Future Work
  - Continued data analysis (seasonal variability, meteorology)
  - Biomarker study (benzene & 1-hydroxypyrene)
  - Community exposure study

Acknowledgements

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